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Apparatus and Method for Coating an Optically Readable Data Carrier

INS A1 The present invention relates to an apparatus and a method for coating an optically readable data carrier, as well as to an optically readable data carrier.

Optical data carriers, such as CDs, as well as methods and apparatus for producing the same, are known. Such data carriers generally have a data-carrying surface that must be protected from environmental conditions. To protect the surface, a hardening lacquer was used in the past that was applied to a central region of the rapidly rotating data carrier so that it would flow outwardly due to centrifugal force and would form an essentially uniform layer upon the CD. However, in this connection the data carrier must be rotated at a high speed in order to produce adequate centrifugal forces for a uniform distribution of the lacquer upon the surface that is to be protected. This process has the inherent danger of damaging the data carrier. Furthermore, with this method excess lacquer is flung out from the data carrier, and must subsequently be removed in a complicated and expensive process.

EP-A-0 855 703 furthermore discloses a method for gluing together two essentially equal, disk-like substrates of a data carrier using an adhesive film that has adhesive on both sides.

Starting with this method, it is an object of the present invention to provide a simplified and economical method for coating an optically readable data carrier as well as a data carrier produced in this manner.

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This object is inventively realized for a method for coating an optically readable data carrier in that a transparent adhesive film that is provided with adhesive on one side is applied to a data carrier surface that is to be protected. The use of an adhesive film has the advantage that the aforementioned centrifuging process for coating the data carrier with a lacquer is eliminated, and no flung-off residual lacquer, which must be removed in an expensive and complicated manner, results. The adhesive film furthermore provides a simple and economical solution for the coating of a data carrier.

In accordance with one preferred embodiment of the present invention, during or after its application to the data carrier the adhesive film is withdrawn from a carrier film. The carrier film has the advantage that the film is protected prior to its application to the data carrier, and the adhesive film has an adequate stability for transport. In addition, a protective film is preferably withdrawn from the adhesive film prior to applying the adhesive film to the data carrier, the protective film protecting the adhesive film surface that is adhesive on one side from contamination and damage prior to its application.

In order to completely cover the data carrier, the shape and size of the adhesive film advantageously correspond to the surface of the data carrier surface that is to be protected. Sections of the adhesive film that correspond to the shape and size of the data carrier are advantageously punched onto the carrier film.

The adhesive film is preferably applied centered on the data carrier surface that is to be protected in order to ensure a uniform coating of all regions of the data carrier. For this purpose the adhesive film and the data carrier are preferably aligned with one another prior to application.

Pursuant to a further specific embodiment of the present invention, during the application the adhesive film is pressed onto the data carrier via a rotating pressure roller, which ensures a reliable contact between the adhesive film and the data carrier. In this connection, the pressure of the pressure roller is preferably controlled in order to achieve an optimum adhesive effect upon the surface of the data carrier.

Prior to pressing by the pressure roller, the adhesive film is preferably held at a pre-specified angle relative to the surface of the data carrier in order to hold the adhesive film at a distance from the data carrier, and to ensure a controlled pressing only in the region of the pressure roller. This prevents air from being trapped between the adhesive film and the surface of the data carrier.

Pursuant to a preferred specific embodiment of the present invention, the data carrier and the pressure roller are moved relative to one another in order to enable a continuing application of the adhesive film upon the surface of the data carrier. In this connection, the data carrier is advantageously moved past the pressure roller linearly, and the pressure roller is advantageously rotated synchronously with the

movement of the data carrier in order to continuously press the adhesive film onto the data carrier.

In one embodiment of the present invention, after the adhesive film has been applied to the optical data carrier, it is hardened in order to provide an increased strength and hence an improved protection of the optical data carrier. In this connection, the adhesive film is preferably hardened by means of a thermal treatment and/or pressure and/or time. Pursuant to an alternative embodiment of the present invention, the adhesive film is advantageously hardened by UV radiation.

A transparent protective layer, in particular a so-called PC-tape, is preferably applied to that side of the adhesive film that is not adhered with the data carrier.

The object of the present invention is also realized by an apparatus of coating an optically readable data carrier, and includes a laminating station for applying a transparent adhesive film having adhesive on one side to a data carrier surface that is to be protected. With such an apparatus, the advantages mentioned above with regard to the method are achieved. In particular, with such an apparatus there is eliminated the danger of damage to the data carrier due to the centrifuging process, and in addition there is eliminated the complicated and expensive preparation and removal of residual lacquer that is flung off.

The object is furthermore realized by an optically readable data carrier having a transparent protective layer, according to which the protective layer is an adhesive film having adhesive on one side. The use of a transparent adhesive film having adhesive on one side as a protective layer leads to the advantages already described above. Pursuant to a presently preferred specific embodiment of the present invention, the data carrier is disposed in a protective housing that surrounds the data carrier. By using a protective housing, the requirements placed upon the protective layer are significantly reduced, since this layer does not have to restrain strong stresses, but rather serves chiefly as a protective layer against contamination and chemical influences.

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The present invention is explained in greater detail in the following using preferred exemplary embodiments with reference to the figures, in which:

Fig. 1 is a schematic representation of an apparatus for producing optical data carriers in accordance with the present invention;

Fig. 2 is a schematic view of parts of a laminating station in accordance with the present invention;

Fig. 3 is a side view of an alternative embodiment of a laminating station in accordance with the present invention;

Figs. 4 is a schematic side view of an alternative adhesive film.

INSA4> Figure 1 illustrates an apparatus 1 for producing an optical data carrier having at least one surface that is to be protected

The apparatus has a feed unit 3 for feeding an optical data carrier, such as a CD or a DVR. The data carrier 6 from the first feed station 3 is conveyed to a laminating station 7 that is described in greater detail with reference to Figures 2 and 3. In the laminating station, a pressure-sensitive adhesive tape or film which has adhesive on one side and is known as PSA tape, is applied to the surface of the optical data carrier 6 that is to be protected. The terms adhesive tape and adhesive film are to be understood as a layer of an adhesive without a carrier material. The optical properties of a layer of adhesive can generally be controlled more precisely and better than those of a coated carrier material. The adhesive film has varying adhesion properties as a function of the pressure applied to it. The data carrier is subsequently placed upon a rotary table 8 having a centering and holding device.

The rotary table is subsequently rotated further until it is disposed in a processing station 11 in which the adhesive film located on the data carrier is hardened. The rotary table is then rotated into an unloading position, where the optical data carrier is removed.

The apparatus 1 is arranged in a clean room in which each of the work steps can be performed under clean room conditions.

Figures 2 and 3 are schematic representations of a laminating station 7 in accordance with the present invention, whereby the components of the laminating stations 7 illustrated in Figures 2 and 3 are arranged somewhat differently. However, the same reference numbers are used for identical/similar components in the following description of the laminating station in accordance with Figures 2 and 3.

The laminating station 7 has a feed roller 22 on which a tape-like laminating film 23 is rolled. The laminating film 23 comprises a total of three films, namely, a protective film 24, an adhesive film 25 that is adhesive on one side, and a carrier film 26, as can be best seen in the enlarged circular detail in Figure 2. The adhesive film 25 has sections 27 that are punched corresponding to the size and shape of a surface of the data carrier 6 that is to be coated.

The laminating station furthermore has a take-up roller 28 on which the remainder of the laminating film 23 is taken up after a laminating process. The laminating film 23 is conducted between the feed roller 22 and the take-up roller 28 around a plurality of guide rollers 30 through 38 in order to provide a defined path for the tape-like laminating film 23 between the rollers 22 and 28. Each of the rollers 30 through 38 is rotatable about its axis of rotation, and the rollers 31 and 37 are designed as so-called compensating rollers that are borne movable in the horizontal direction in order to make it possible to compensate for the length of the laminating film 23 between the rollers

22 and 28. This makes it possible for the rollers 22 and 28 to be rotated at a constant speed despite discontinuous laminating cycles, as will be described in the following. The parts of the adhesive film 25 that are not needed can be removed in advance, that is, prior to introducing the laminating film into the laminating station, for instance during production of the laminating film, or they can remain on the film in order to ensure a uniform thickness of the film 23 across the entire width and length thereof, at least prior to a laminating process.

The laminating film 23 is furthermore conducted around a wedge-shaped blade 40, where the laminating film 23 turns sharply in order to make it possible to remove the protective film 24 from the laminating film 23 so that the adhesive side of the adhesive film 25 is exposed for adhering with the optical data carrier 6. The removal of the protective film 24 is best seen in Figure 3. Once removed, the protective film 24 is rolled onto a roller (not shown in greater detail). An alternative type of film removal device could also be used instead of the wedge-shaped blade 40.

Once the laminating film 23 has been conducted around the blade 40, it is conducted around the roller 33 that is lower with respect to a horizontal and that is embodied as a pressure roller. After the roller 33, the laminating film 23 is conducted about the shaft 34, which is driven via a motor 42.

Rotation of the driven roller 34 causes corresponding rotation of the pressure roller 33 and a downstream roller 35 that is embodied purely as a guide roller.

The laminating station 7 has a first sensor 45 that is associated with the driven roller 34 and that is able to detect contours in the punched sections 27 of the adhesive film 25. The laminating film 23 is moved back and forth in the longitudinal direction via the driven roller 34 until the sensor 45 detects a certain contour of the punched sections 27, such as for instance a punched center hole. When the sensor 45 detects the center hole, it is positioned directly over one edge of the center hole by the movement of the film, this resulting in precise alignment of the section 27 with respect to the roller 34 and in particular the pressure roller 33 in the longitudinal direction of the laminating film 23.

The laminating station 7 furthermore has a support and transport unit 47 for the data carrier 6 to be laminated. The support and transport unit 47 forms a horizontal support for the data carrier 6 and can be moved in any direction via suitable moving apparatus (not shown in greater detail). A lowerable centering pin 48 ensures precise alignment of the data carrier 6 on the support and transport unit 47. The pin 48 can be lowered during the laminating process so that it is not impaired. This is achieved in that it is pressed upward into the position shown in Figure 3 by a spring with relatively limited spring force. When pressure is exerted on the pin from above, it is pressed

downward against the spring force. Alternatively, the pin can be moved via a cylinder or motor.

Prior to the lamination of the data carrier 6, the transport and support unit 47 is moved in the X direction, which corresponds to the longitudinal direction of the laminating film 23, against a stop. This ensures that the substrate 6 and the section 27 of the adhesive film 25 previously aligned in the longitudinal direction are aligned to one another. Then the transport and support unit 47 is moved back and forth in the Z direction, which runs transverse to the longitudinal direction of the laminating film 23. A sensor pair 50 allocated to the transport and support unit 47 detects a contour, such as for instance the contour of a center hole, of the punched section 27 of the adhesive film 25, which makes it possible to laterally align the data carrier 6 with respect to the section 27.

Once the data carrier 6 has been aligned in the above manner both in the X direction and in the Z direction with respect to the section 27 of the adhesive film 25, the transport and support unit 47 is raised in the Y direction. Now the motor 42 drives the roller 34, which causes the laminating film 23 to move in the X direction. At the same time and synchronized with the rotation, the transport and support unit 47 is moved in the X direction. The section 27 comes into contact with the surface of the data carrier 6 to be protected and is pressed thereagainst by the pressure roller 33 such that it adheres to the data carrier 6 and detaches from the carrier film 26. The synchronized

movement of the drive roller 34 with the transport and support unit 47 applies a section 27 of the adhesive film 25 centered on the data carrier 6 so that the section 27 of the film 25 completely covers the side of the data carrier 6 to be protected and does not project over the edge. The pressure of the pressure roller in the Y direction is controlled via the position of the transport and support unit 47 in order to control the adhesion properties of the pressure sensitive adhesive film 25. Alternatively, of course, the pressure roller 33 can move in the direction of the transport and support unit. A spring-type suspension system can be provided for good control or compensation of the pressure. The suspension can be provided via a spring or compressed air cylinder.

Then the data carrier 6 thus provided with the section 27 of adhesive film 25 is transported via a suitable handling apparatus 52, such as an interior hole gripper, removed from the transport and support unit 47, and is transported to the rotary table 8 in accordance with Figure 1.

A new data carrier 6 is loaded onto the transport and support unit 47, and the process is repeated. As was mentioned in the foregoing, the rollers 22 and 28 rotate continuously during the entire process, although the adhering process is discontinuous. The longitudinal compensation of the laminating film 23 that is therefore necessary is achieved via a horizontal movement of the compensating rollers 31 and 37, as already mentioned in the foregoing.

Although the laminating film has three layers in accordance with the description in the foregoing, namely a protective film 24, an adhesive film 25, and a carrier film 26, it should be noted that it is not absolutely necessary for there to be a protective film 24. However, if no protective film 24 is used, at least the rollers 30 and 32 should be specially coated in order to prevent the exposed adhesive film 25 from adhering to these rollers.

Alternatively, the guide rollers up to the roller 33 can be omitted, whereby in this case the rollers 22 and 28 must be controlled such that the sections 27 are aligned and a movement of the laminating film 23 is achieved synchronized with the transport and support unit 47.

In addition, a single sensor, such as for instance a camera, can be used for the above alignment processes instead of the sensors 45 and 50.

As described above, by means of the rotary table 8 the data carrier 6 is transported into the process station 11, in which the adhesive film is hardened.

Figure 4 shows an alternative embodiment of a band-shaped laminating film that can be utilized in the aforementioned laminating station. In Figure 4, the same reference numerals are utilized to the extent that they designate the same or similar elements. The laminating film 23 again comprises three films, namely a protective film 24, an adhesive film 25 having,adhesive on one side, and a carrier film 26. In contrast to the previously described embodiment, the adhesive

film does not comprise a single layer of adhesive material. Rather, the adhesive film 25, which has adhesive on one side, is built up of an adhesive layer 60 and a protective layer 62, such as, for example, a PC tape. By means of the PC tape, the adhesive film receives additional stability, and the PC tape furthermore has special optical characteristics that are of advantage, in particular, with a DVR. The adhesive film 25 has the previously described sections that are punched out in conformity with the size and shape of a data carrier surface that is to be adhered. With this type of adhesive film, the processing station 11 can be eliminated since a hardening of the adhesive film is not necessary.

The present invention was previously described with the aid of preferred exemplary embodiments of the invention, without, however, being limited to these special embodiments. For example, the data carrier can, in the manner of a diskette, be disposed within a housing that surrounds it, which greatly reduces the mechanical requirements made on the coating. In this case, the processing station 11 could be eliminated, since after the lamination of the adhesive foil (adhesive layer) no further processing step would be necessary. The hardening of the adhesive layer can be effected by pressure and/or time and/or by an irradiation, such as with UV light, or by a thermal treatment.

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